

Progress Report I

Design Team 1

**Accessible Manufacturing Equipment
Fall Semester 2008**

Design Progress Thus Far

First Weeks

From the very first meeting with our sponsor contact, Stephen Blosser, we have had a fairly clear idea of how our final project should function, and what components would be needed to construct the design. The automated ribbon cutting machine would be centrally controlled by a PIC microcontroller, some sort of clamps would be used to grasp the ribbon, and any motion in the design would be accomplished using electromechanical actuators.

The first few weeks of design, after our sponsor meeting, were spent evaluating possible components for use in the prototype. Our sponsor had donated a collection of stepper motors, the rotary cutter to be used, and also a complete programming solution for the audio feedback of the system. We had to then search for clamp, motion stage, and display solutions. For the display, a collection 7-segment LED displays was chosen because of low cost, and ease of implementation. The clamp and motion stage designs, however, were less clear. For clamps, we first considered heavy duty screw clamps that could be driven with stepper motors. This particular solution was dropped due to high price and difficulty of implementation. Two subsequent meetings with our sponsor, however, changed the course of our expected clamp design. The first yielded a discussion of perhaps using bicycle caliper brakes which could be driven by actuators to grab the ribbon. This was agreed upon to be tested. Our sponsor contact tested the bicycle calipers and upon doing so found them to be too difficult to implement in our design. The following sponsor meeting produced our current solution for clamping our material, which is a custom built solution designed by Mr. Blosser. A similar string of occurrences surrounded the motion stage solution. We reviewed many premade linear motion stages. Though almost all of them would have been very simple to implement and robust, these solutions were well out of our budget range for the project. Mr. Blosser will be providing a custom built solution for the motion of the movable clamp and the cutter.

Now that decisions had been made regarding the major mechanical portion of our design, it was our next responsibility to make decisions on electrical components and IC's. We reviewed many IC solutions for driving our stepper motor and found that there were two common approaches. We could drive the stepper with a pair of IC's such that one circuit, a logic translator, would be controlled by the PIC, and that logic translator would control the power driver that would energize the motor. A second solution was an IC that contained both the logic translator and the power stage on the same IC. This second solution was chosen due to ease of implementation and lower cost.

Middle of Semester

Our first prototyping goal was to achieve controlled motion (i.e., precise control of both direction and speed) of a stepper motor. Once we received our stepper driver IC's (again, the ones that contained both logic translation and power stages) we constructed our first stepper driver IC. The data sheet for our particular stepper driver IC, the L6228, included a detailed 'Typical Application' circuit. This was the circuit we constructed to drive the motor. This circuit was successfully wired, tested, and functioning properly in approximately four hours. This was achieved on the afternoon of October 8, 2008.

With a working prototype for stepper motor control, we next decided to focus on the audio feedback circuitry in our design. We spent an afternoon familiarizing ourselves with the Quadravox audio software and programming board. After some initial mistakes with the audio board and software settings, we had successfully programmed an ISD1420P chip with a handful of samples. These samples were then played directly off the ISD chip (still connected to the programming board) for verification. Next we attempted to add our own recorded WAV files to the chip. In doing so, we ran into a problem with available memory on the chip. Our personally recorded WAV files, as they were, could not fit on the chip. It had only memory for up to 20 seconds of recording. This forced us to search for another ISD chip with larger memory. We found a chip with four minutes of recording time that was compatible with our Quadravox programming setup. This chip was ordered and arrived promptly within a few days. Unfortunately, we had not inspected the new chips closely enough before we ordered them, and it was discovered that the new chips were programmed and operated via serial interface, which was something we were not comfortable pursuing. However, upon further investigation of the Quadravox website, we found many pre-recorded audio files for free download. We downloaded these audio collections and found that we could fit the needed files onto our original ISD chip using the new audio files. With regard to the audio, the next step was to interface the ISD circuit with our PIC microcontroller. This was successfully wired and working on the afternoon of Monday, October 13.

Our stepper motor setup, though functional, raised concerns about sufficient speed and torque, so we ordered a larger stepper motor with a large amount of torque. Upon arrival of this device, we discovered that the power supplies in the lab could not supply enough current to properly

power the motor. A new power supply is currently being researched, as well as the appropriate circuitry that may be required.

With regard to our display, the components (drivers and DMUX) just recently arrived, and the circuit is currently under construction.

Summarized Progress Report

- Early design discussions (weeks 1-3)
- A general design for prototyping is agreed upon (week 3)
- Component research conducted (week 4)
- First parts (stepper driver) ordered (week 4)
- First parts arrive (week 5)
- Stepper driver circuit built and working (week 5)
- Display components ordered (week 6)
- Audio chip programmed (week 7)
- New audio chip ordered (week 7)
- New audio chips and display drivers arrive (week 7)
- Pre-recorded files loaded on original audio chip (week 8)
- Final audio setup interfaced with microcontroller (week 8)
- Building begins on LED display (week 9)